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(54) Cap for thrust bearing

(57) The motor has a thrust cap (50) fitted to its end cap by snap fit fingers (54). The thrust cap (50) closes a hole (46) in the bearing retainer (42) of the end cap and provides a thrust bearing surface (52) against which the end of the shaft contacts to limit axial movement or end play of the shaft.

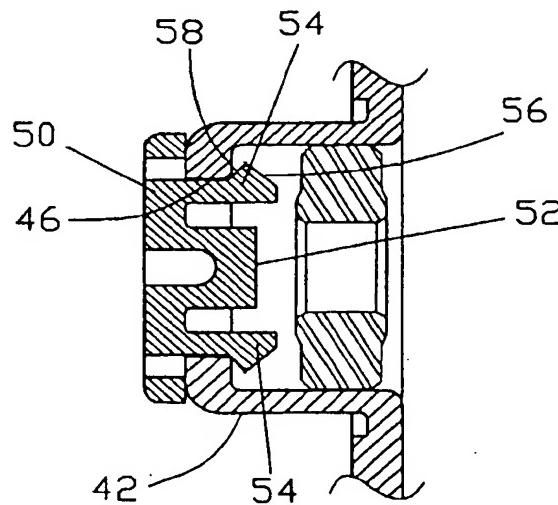


FIG. 3

Description

[0001] This invention relates to an electric motor and in particular, to a miniature electric motor with a combined bearing cover/thrust plate.

[0002] Small electric motors are very common and are often used with pinions fitted to the output shaft. Usually, such motors will have a thrust bearing of some form to limit the axial movement of the shaft. However, often the pinion is fitted to the output shaft after the motor has been fully assembled by the purchaser of the motor. As a result, the thrust bearing is damaged when the pinion is fitted due to the relatively large force required to press the pinion on to the shaft which is bearing directly onto the thrust bearing.

[0003] One solution to this problem is to use stronger thrust plates but while this reduces the damage to the thrust plate, it does not eliminate the damage and it does add significantly to the cost of the motor. Alternatively, the force required to fit the pinion can be reduced but this can lead to other problems such as loose pinions.

[0004] Hence, there is a need for a thrust plate which can avoid being damaged during fitting of a pinion to the output shaft of a miniature electric motor.

[0005] Accordingly, the present invention provides a thrust cap for an electric motor comprising: a thrust cap body; a thrust bearing surface supported by the body; and securing means for securing the thrust cap body to the electric motor.

[0006] Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings.

Figure 1 is a part sectional view of an electric motor incorporating a thrust cap according to a first embodiment;

Figure 2 is an end view of the motor of Figure 1;

Figure 3 is an enlarged sectional view of a part of the motor of Figure 1 showing the thrust cap;

Figure 4 is a view similar to Figure 3 showing a modified thrust cap according to a second embodiment;

Figure 5 is a sectional view of a modified thrust cap according to a third embodiment; and

Figure 6 and 7 are schematic diagrams used to explain the function of the modified thrust caps.

[0007] A miniature PMDC motor 10 is shown in Figure 1. The motor has a can-like housing 12 having an open end and a closed end. The housing 12 supports a magnet stator 14. The closed end of the housing supports a sintered bronze bushing 16. A rotor 18 has a

shaft 20 journalled in the bushing 16, an armature 22 and a commutator 24.

[0008] The open end of the housing is closed by a two part end cap 30. The end cap has a plastics material part 32 and a metal part 34. The plastics part supports and insulates the brush gear, only a single fingerleaf brush 36 is shown, and motor terminals 38, from the metal part 34. Posts 40 on the plastics part 32 are used to connect the two parts of the end cap together by being plastically deformed after being passed through corresponding holes in the metal part 34. The metal part 34 has a bearing retainer 44 accommodating a second sintered bronze bushing 44 which supports one end of the shaft 20. The bearing retainer 44 has a central opening 46 through which access to the end of the shaft can be made. A thrust cap 50 closes this opening.

[0009] Figure 2 is an end view of the motor of Figure 1 showing the thrust cap 50 fitted to the end cap 30. Also visible are the four posts 40 and two motor terminals 38. The connection between the end cap 30 and the housing 12 is by way of crimps at the four locations labeled 48.

[0010] The thrust cap 50 and the connection between the thrust cap and the bearing retainer 42 is more clearly shown in Figure 3. The thrust cap has a bearing surface 52 which is flat and arranged to be born against by the end of the shaft which is rounded to reduce friction. The thrust cap has four fingers 54 which have tapered heads 56 with shoulders 58 forming an abutment surface. The fingers are resiliently deformable to allow the heads to pass through the opening 46 and spring back to engage the shoulders with the inner surface of the bearing retainer, thus forming a snap fit connection with the bearing retainer. The shoulders are sized and shaped to retain the thrust cap in position against the maximum or greatest expected axial thrust developed by the shaft in normal use.

[0011] The thrust cap is preferably formed from a moldable low friction material such as PTFE (TEFLON) to reduce friction as the thrust cap is in direct contact with the end of the shaft.

[0012] Figure 4 shows a thrust cap 50 according to a second embodiment. This thrust cap is constructed and fitted to the motor in the same manner as the thrust cap of the first embodiment with the exception that the bearing surface 52 is formed on an arm 60 integrally formed with the thrust cap. The arm extends from the body of the thrust cap offset from the shaft axis and at an angle to the shaft axis in its free state. The arm, which is resiliently deformable provides a spring like effect on the bearing surface which contacts the rounded end of the shaft offset from the shaft axis. The spring like effect allows the bearing surface to remain in contact with the shaft as the shaft moves axially and provides an increasing resistance to axial movement as the shaft moves axially toward the thrust cap.

[0013] Figure 5 shows a thrust cap 50 according to

a third embodiment. This cap is similar in construction to the thrust cap of the first embodiment with the exception that the bearing surface 52 is provided by a U-shaped spring 62 fastened by rivet 64 to the body of the thrust cap which is very similar to the thrust cap of the first embodiment. As the body of the thrust cap is not in direct contact with the shaft 20, it is not necessary for it to be made of low friction material and cheaper suitable materials can be used with the spring 62 being of suitable low friction spring material such as beryllium copper or stainless steel strips.

[0014] The thrust cap of the invention as illustrated by the embodiments allows a pinion or cog to be fitted to the shaft of the motor without damaging the motor's thrust bearing by providing a thrust bearing which can be fitted to the motor after the pinion or cog has been fitted. Before the thrust cap is fitted, access to the end of the shaft can be gained through the opening 46 in the bearing retainer to support the shaft during fitting of the pinion or cog. After the pinion or cog has been fitted, the thrust cap of the preferred embodiment is snapped into place to provide the thrust bearing to limit end play (axial movement of the shaft) during use.

[0015] The second and third embodiments add a further feature of spring loading the thrust bearing surface. This avoids the knocking noise which is generated as the motor shaft strikes a hard thrust surface.

[0016] Figures 6 and 7 are schematics showing the effect of the offset spring force and illustrate a further advantage of providing a sprung thrust face in which the point of contact is offset from the axial centre of the shaft. As the shaft end is rounded, an axial force offset from the axis will have a radial component as well as an axial component. The axial component limits the end play while the radial component will be arranged to assist gravity and/or other radial force to urge the shaft to contact the bushing's bearing surface at a predetermined location. This helps to reduce bearing rattle which occurs when the shaft, as it rotates, tries to crawl around the bearing surface and then falls.

[0017] Variations and modifications will be evident to the skilled addressee without departing from the spirit of the invention described and it is intended that all such variations and modifications are covered by this application.

- 5 2. A thrust cap according to claim 1 wherein, the securing means comprises a plurality of snap fit fingers (54) having tapered heads with shoulders which engage an inner surface of the housing.
- 10 3. A thrust cap according to claim 1 or claim 2 wherein, the thrust bearing surface (52) is sprung and is arranged to continuously contact the end of the shaft to urge the shaft axially away from the thrust bearing cap.
- 15 4. A thrust cap according to any one of the preceding claims wherein, the thrust bearing surface (52) is integral with the thrust cap body (50).
- 20 5. A thrust cap according to any one of the preceding claims wherein, the thrust bearing surface (52) is formed by an arm (60) extending from the thrust cap body (50) and able to be resiliently deformed within a predetermined range by the shaft.
- 25 6. A thrust cap according to claim 1, 2 or 3 wherein, the thrust bearing surface (52) is provided by a U-shaped spring (62) fixed to the thrust cap body (50).
- 30 7. A thrust cap according to any one of the preceding claims wherein, the thrust bearing surface (52) is adapted to extend perpendicularly to the shaft
- 35 8. A thrust cap according to any one of claims 1 to 6 wherein, the thrust bearing surface (52) is adapted to bear on the end of the shaft at a position spaced from the axial centre so as to urge the shaft in a radial direction and an axial direction.
- 40 9. A miniature electric motor characterised by a thrust cap according to any one of the preceding claims.

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Claims

1. A thrust cap for an electric motor having a housing and a shaft, the thrust cap comprising:
 - 50 a thrust cap body (50);
 - 55 a thrust bearing surface (52) supported by the body and adapted to contact an end of the shaft; and
 - 55 securing means for securing the thrust cap body (50) to the housing of the electric motor.

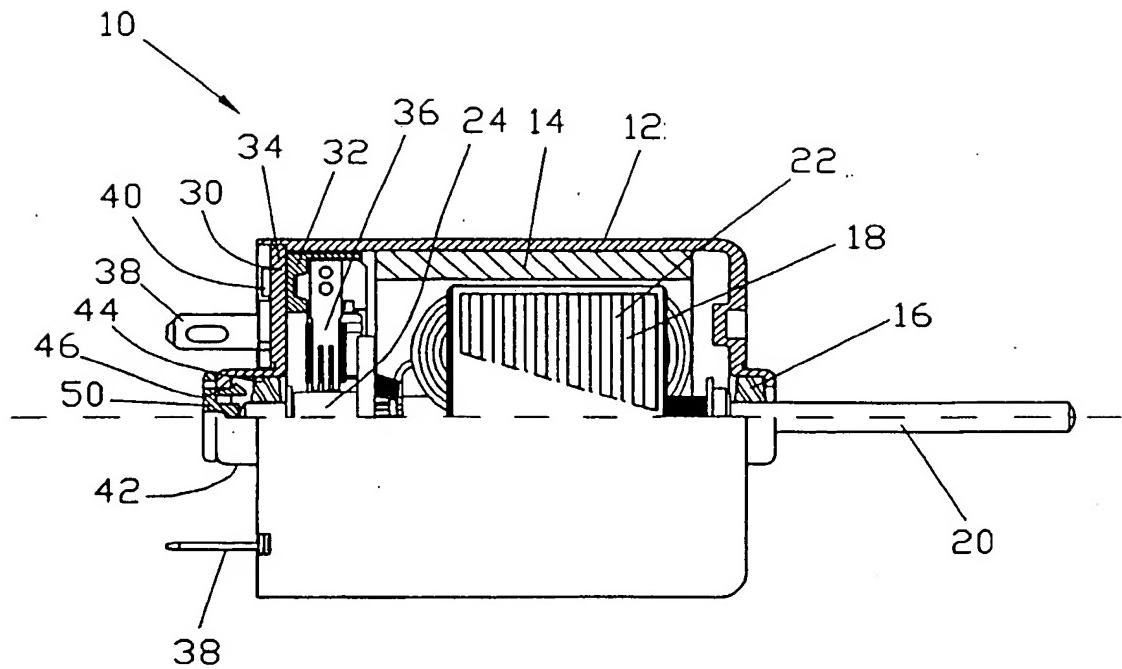


FIG. 1

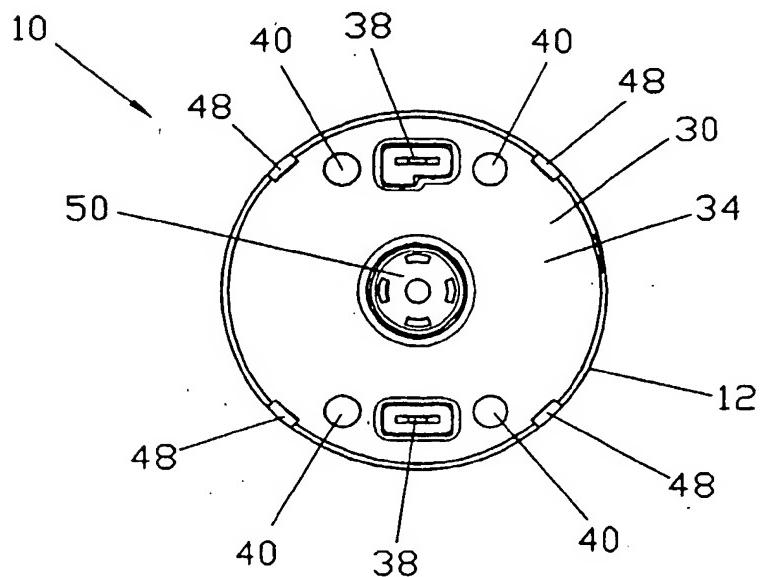


FIG. 2

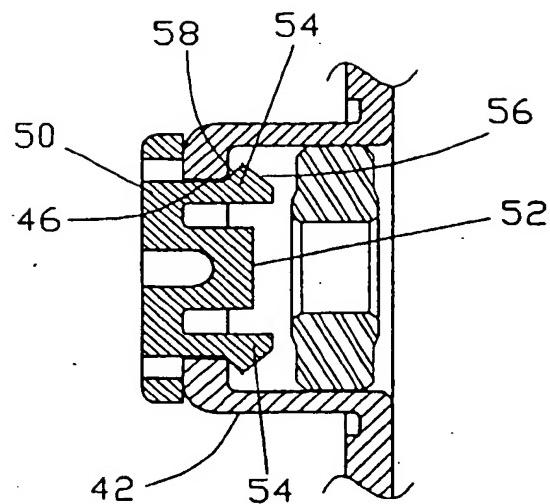


FIG. 3

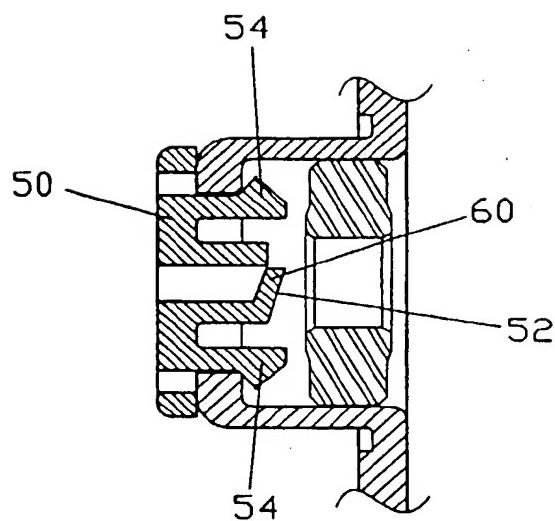


FIG. 4

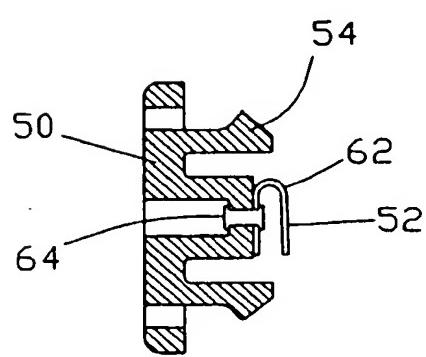


FIG. 5

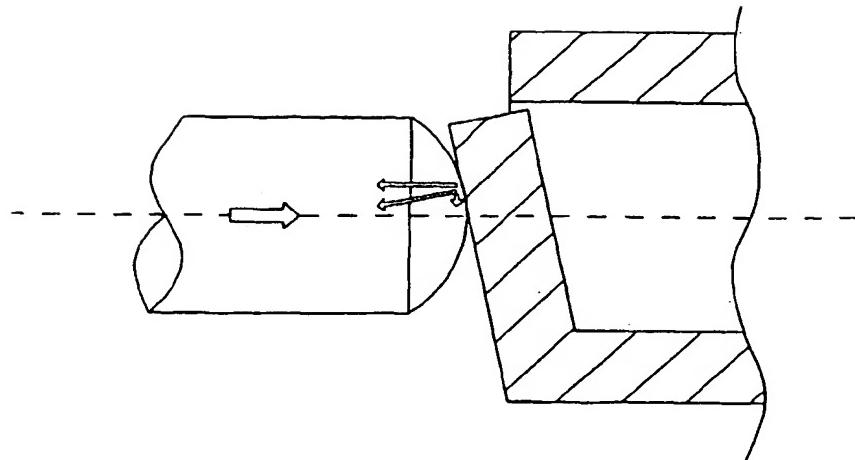


FIG. 6

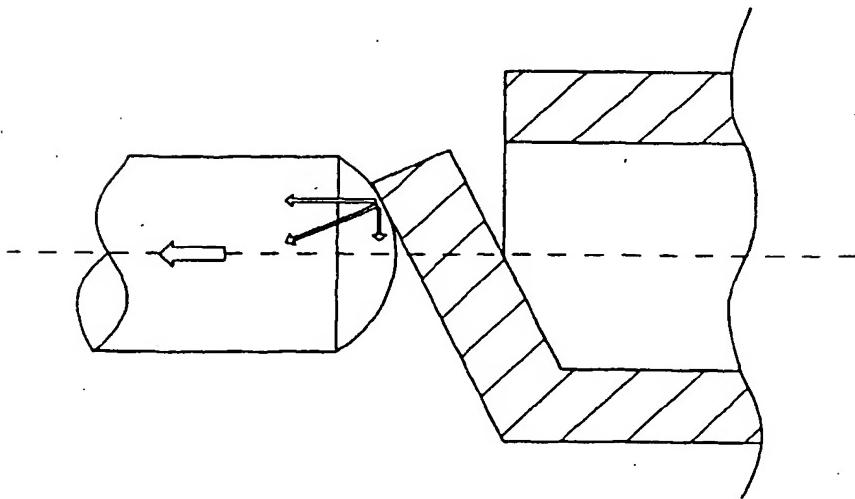
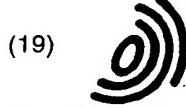


FIG. 7



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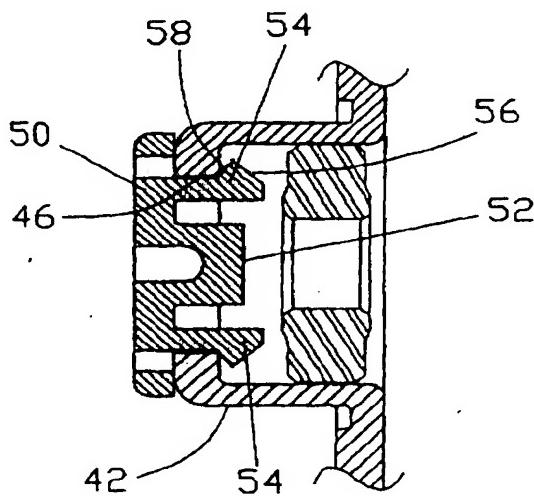


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number

EP 00 30 8710

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| <p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of compilation of the search</td> <td style="width: 33%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>31 January 2003</td> <td>Ramos, H.</td> </tr> </table> <p>CATEGORY OF CITED DOCUMENTS</p> <ul style="list-style-type: none"> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document <p>T : theory or principle underlying the invention</p> <p>I : earlier patent document, but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>4 : member of the same patent family, corresponding document</p> | | | | Place of search | Date of compilation of the search | Examiner | THE HAGUE | 31 January 2003 | Ramos, H. |
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| THE HAGUE | 31 January 2003 | Ramos, H. | | | | | | | |

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 30 8710

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31-01-2003

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